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ABSTRACT

This document presents case studies of three schools or districts in Oregon that have implemented steps to promote energy efficiency. Steps taken by the schools include daylighting, energy audits, special energy loans, new ventilation design, and sustainable building practices. The facilities described are Ash Creek Intermediate School in Monmouth, North Santiam School District, and Dalles Middle School in Dalles. (EV)

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ED 479 495

Energy-Efficient Schools

Three Case Studies from Oregon

1. Ash Creek Intermediate School
2. North Santiam School District
3. The Dalles Middle School

2003

Full text available at:
http://www.energy.state.or.us/school/schlhm.htm

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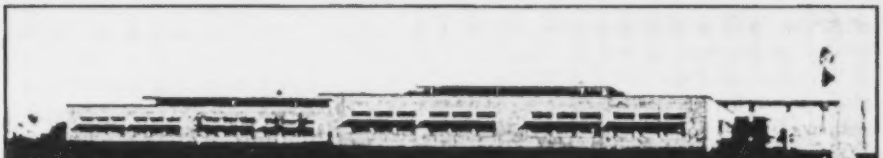
Case Study: Ash Creek Intermediate School



View of Ash Creek from the south shows the exterior light shelves that shade the lower windows and therefore eliminate overheating in the classrooms.

New Ash Creek school gets the most value for funds spent

As superintendent of Central School District 13J in Monmouth-Independence, Forrest Bell knows he has a responsibility to get the most value for the district's money. When Ash Creek Intermediate School opened in September, it was evident that the district's construction dollars were well spent. They got a high performance school for a very reasonable cost.

"We weren't seeking a showpiece. We wanted a functional and flexible space that will serve us well for 100 years."

– *Forrest Bell, Superintendent of Central School District*

"We weren't seeking a showpiece," Bell said. "We wanted a functional and flexible space that will serve us well for 100 years. We wanted a building that gets us the most value for our dollar and gives our kids an advantage."

And, that is exactly what a high performance school is. It is a school building that uses energy and resources efficiently, is easy and inexpensive to maintain, and provides a comfortable, stimulating and healthy environment for students and staff. Best of all, a high performance school does not cost more to build than a conventional school.

"People don't realize how expensive it is to operate an inefficient school facility," Bell said. He knows. Monmouth Elementary, a similar-size building built in the 1960s, had electric bills amounting to $78,000 last year. Ash Creek's bill is expected to be half of that figure.

Ash Creek was built 30 percent more efficient than the Oregon building code standard that is considered one of the better codes in the nation.

Ash Creek is a prototype," said Bell. "We want people to recognize that the features in this building are ones they should expect and demand."

Voters in the Central School District passed the construction bond for Ash Creek in 1998. Although, population growth had remained flat, the elementary and junior high schools in the district had been overcrowded for 10 years. Ash Creek, a 58,000

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625 Marion St. NE,
Suite 1
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•
(503) 378-4040
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square-foot-building with 400 fifth and sixth grade students, was created to relieve that pressure.

BOORA Architects of Portland won the design bid over 30 other firms because they bid the lowest cost building. Heinz Rudolf, an architect with BOORA and an advocate of energy-efficient sustainable buildings, oversaw the project.

"Ash Creek is a fabulous building because it is designed for sustainability and energy efficiency and will respond to the educational needs of the kids," Rudolf said. "The school is their home away from home and sets the tone for youngsters that will last a lifetime."

Ash Creek Intermediate School

1360 N. 16th Street
Monmouth, OR

Central School District 13J
Principal: Barbara Welander
Superintendent: Forrest Bell

Architect: Heinz Rudolf, BOORA
Construction Company: Woodburn Construction Company

Cost: $124 per square foot (includes extensive site work)
58,000 square feet
403 students in grades 5 and 6
15 acres

Daylighting

One of the most visible features of the building is the amount of natural light inside the building.

"Some school districts can't afford to turn their lights on in their older buildings and the classrooms are very dark," said Rudolf. "At Ash Creek, we used nature as our ally."

"The light level is the first thing that parents comment on," said Ash Creek Principal Barb Welander. "They really like how light and open the school is."

"Natural light is the highest quality light source for visual tasks, as it enhances the color and appearance of objects," said School Energy Analyst Greg Churchill with the Oregon Office of Energy. "A high performance school uses as much natural light as possible, especially in classrooms, while avoiding excessive heat loss, heat gain, and glare."

Churchill notes one study that indicates that daylighting enhanced Seattle student performances by 15 percent on reading tests and 12 percent on math tests. The study accounts for over 50 variables and is considered 99 percent accurate in its conclusions on the correlation between natural daylighting and student performance. (See the Office of Energy Web site: www.energy.state.or.us/school/Daylight.pdf to view the study.) Classrooms stay cooler and more comfortable when artificial lights are turned off. And, there is less energy used.

Clerestories in the 18-foot high hallway provide natural daylighting with uniform light levels within the hall.

Ash Creek introduces natural light into the building in several ways:

1. The one-story school is oriented north and south to obtain maximum, controlled, balanced daylight.
2. Clerestories, windows placed high on one side of a wall, bring light into the 18-foot high hallways and into the media center.
3. The media center has insulated skylights that diffuse the natural light.
4. The gym has windows placed high to bring in light.
5. Classrooms have light tubes that are much smaller in diameter than a skylight and made of reflective material to bring direct sunlight and ambient light through the ceiling and into the room. A diffuser spreads the light evenly.

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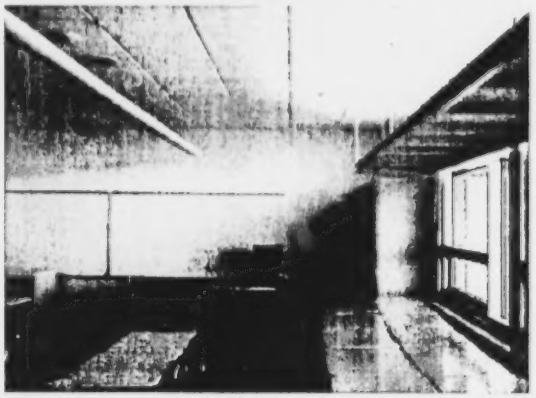
6. The school added light "shelves" to the design to bring more light into the classrooms. Light shelves are built on the outside and the inside of the windows. These approximately three-foot reflective projections are located about a third of the way down the window. They reflect the sunlight to the white ceiling which "bounces" the light deeper into the room. The shelves also shade the lower window and reduce heat gains into the room caused by the sun.
7. The classrooms have energy-efficient T5 fluorescent lights. They have sensors that automatically turn them off when there is sufficient natural lighting or when the room is unoccupied. Dimming ballasts allow the T5s to be used more efficiently when needed while producing acceptable light levels.
8. Windows on the east and west sides of the building have translucent glass to prevent glare and heat gain within the building.
9. Light-colored banners are arranged in interior common areas to deflect light into the building. They also enhance the acoustics of the area.



Classroom view shows how the outside light "bounces" into the room off the light shelves inside the room.

Superintendent Bell was convinced of the value of daylighting when he visited the Seattle Lighting Lab and saw the modeling analysis of Ash Creek. The lab had modeled simulations of the building for the school location, site orientation and design on clear, overcast and rainy days.

"Even on the darkest winter day, the light lab modeling showed there was adequate, good quality light," Bell said.

Student teacher Kathy Child from Western Oregon University has noticed the natural light is more than adequate for reading and classroom work. And, she adds it just "feels better."

Principal Welander says its too early to make conclusions about student performance and the use of natural lighting. She said, however, the staff has commented that there aren't as many behavior problems as expected in the first few weeks of school.

Ventilation

Ash Creek classrooms have operable windows and ceiling roof vents on the inside corner of the rooms to provide cross ventilation. Bell noted that he was in the building during the summer when the thermometer hit over a 100 degrees and the building was still quite comfortable. By using natural ventilation, only a few areas in the school actually require air conditioning.

Natural ventilation can be easily controlled. It connects students and staff to the outside and saves energy, maintenance and has lower initial costs.

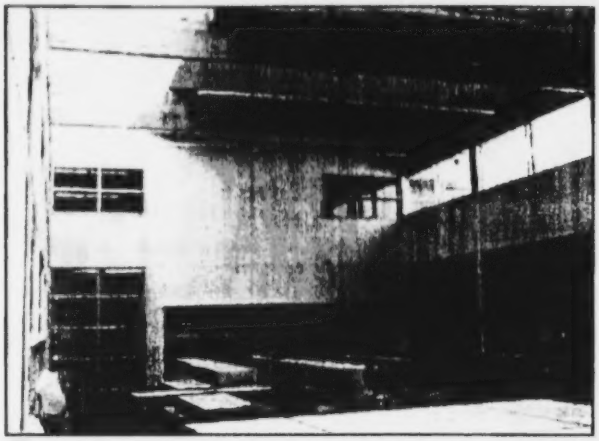
Efficient and attractive flat wall-unit hydronic radiators warm the fresh air, if necessary. There are no fans with the units which saves a considerable amount of energy.

Easy to Maintain, Resource Friendly

Light-colored linoleum floors are easy to maintain. Some walls are accented with rough-cut cedar, but most are light-colored to enhance the light level.

Other earth-friendly features of Ash Creek:

1. They encourage kids to ride their bikes to school. There is covered parking for 30 bicycles and road improvements so kids can ride their bikes safely to school property.
2. They used water conserving plumbing fixtures throughout the school.
3. They used durable materials such as aluminum-clad windows and concrete. Little paint is used on the outside to reduce maintenance costs.
4. They used materials produced locally saving on transportation costs and fuel use.
5. They used paints, wood stains and sealers with low or no-volatile organic compounds (VOCs) as much as possible. This reduced emissions of noxious odors and produced healthier air quality.



The clerestory and spun fiberglass skylight provide ample light in the media center.

6. The gym floor is made with a lower-than-premium grade of lumber that doesn't affect its use or appearance. This cost less and saved premium timber from being cut.

Built for the Future

Careful planning went into the design of Ash Creek so it would meet future needs without adding more space. For example, the cafeteria is designed to serve primarily as the dining area. However, it has a stage so it can serve as an auditorium. It has sinks so it can be used for large science or art classes. And, it can serve as a general meeting space.

The music room has a stage for performances, but can also be used a meeting room.

The Central School District recently received an Energy Award for School Design of a High Performance School from the Oregon Office of Energy. In making the presentation, Office of Energy Director Michael Grainey said that the Central School District's high performance intermediate school is an asset to the community, enhances teaching and learning, reduces operating costs and protects the environment.

The Oregon Office of Energy produced an energy analysis for Ash Creek Intermediate School during the design phase. More information on high performance schools and case studies are available on the Office of Energy Web site at www.energy.state.or.us/school/highperform.htm

Superintendent Bell is pleased that the taxpayers' money was well spent and the school can serve students and the community for years to come.

Greg Churchill
(503) 378-4040 or (800) 221-8035 • www.energy.state.or.us

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Case Study: North Santiam School District

Homework pays off for North Santiam Schools

It's no small feat to stretch $350,000 into $1.2 million to upgrade antiquated school buildings in today's economic environment. But, North Santiam School District, located in the foothills of Oregon's Central Cascade Mountains, diligently did its homework and accomplished the seemingly impossible with its partners the Oregon Office of Energy, Nike and Siemens.

> ***"This is a win-win for everyone. This is good for the environment and good for the schools. It shows how partnerships between government and business can save Oregon's greatest resources, schools and the environment."***
>
> *- Jim Petsche*
> *Director of Corporate Facilities*
> *Nike*

"Four years ago, we made our facilities a priority," said North Santiam School Board Chair Dave Kinney. "There is no doubt that the learning environment is affected by the physical environment."

And, the district's school buildings were in dire need. The outdated lighting fixtures in most classrooms created a buzzing background noise, continually flickered and provided a low quality light. The classrooms were often uncomfortably hot or cold because the old heating valves would get stuck in the wrong position. The maintenance staff kept busy answering complaints and had less time for other work.

New Facilities Manager

Tom Hogstad joined the school district in August of 2000 as the district's first full-time facilities director. "It was very apparent to me from the start that we had some basic problems with the school infrastructure – lighting and heating and cooling in particular," Hogstad said. "A review of the utility bills showed we were spending way too much money per square foot for energy and too much of our maintenance staff's time on energy-related issues."

But, like most Oregon school districts today, North Santiam had no money for improvements.

Hogstad, who had just come from private industry in Bend, didn't flinch at his prospects for success. He had some important positives on his side: Dave Kinney and the School Board and District Superintendent B.J. Hollensteiner.

"B.J. created an environment for creative

Stayton Elementary School and Stayton Middle School students, teachers and staff benefited from lighting and heating/cooling system improvements.

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Suite 1
Salem, OR 97301-3742

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problem solving," said Hogstad. "She encouraged us to use our skills — learned in both the public and private sectors — to make change happen."

Stayton Elementary School improved its lighting with funds from Nike and SB 1149 funds.

First step

Hogstad's first step was to create a monitoring program to see where the problems were. He had some background from an energy management course he had taken.

Hogstad also called the Oregon Office of Energy's School Program Energy Analyst Greg Churchill to see if he could help. Churchill explained that the 1999 Legislature had passed a bill that would have an impact on energy regulation and would provide financial assistance for school energy projects.

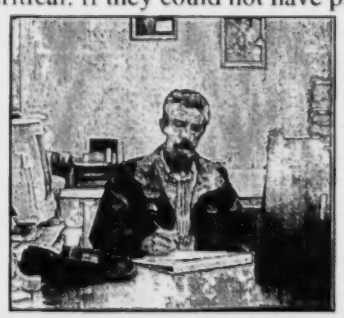
Senate Bill 1149 would restructure the regulated electric industry. The bill also provided for a 3 percent "public purpose charge" to be collected by the two investor-owned utilities, Portland General Electric and Pacific Power. A portion of the charge would be directed to school energy projects. The bill required energy audits of all school district facilities before releasing funds. It would take effect March 1, 2001.

With his homework done, Hogstad went into action. He got approval to put out a request for proposals (RFPs) for performing energy audits, providing service on the more technically advanced heating and cooling equipment, assisting with development of a strategic plan and accessing funds.

The criteria: "We wanted to resolve the problems and be budget neutral, provide lower energy and maintenance costs, be environmentally friendly and be good stewards of the taxpayer's money," Hogstad said.

Siemens Building Technology's proposal met the district's criteria. Eric Latimer was the Siemens contact for North Santiam.

"Eric and Siemens were wonderful partners in this," said Hogstad. "Siemens' ability to provide integrated services — audit, project development, financing analysis, installation and post-construction support — was critical. If they could not have provided all of these services, we would still be developing the project — not celebrating its completion."



Tom Hogstad, former facilities manager at North Santiam, is now a part-time consultant for the district.

Latimer started attending Hogstad's "Action Team" meetings with district maintenance mechanics Ron Osborne, Bob Gore, Dave Travers and Ken Rawlings. Osborne was designated to manage the installation portion of the energy project.

"Ron is great with the details. I'm more the creative thinker," said Hogstad. "Between the two of us, and with the help of the entire maintenance team, it truly was a cooperative process."

Audits and priorities

Siemens quickly started the energy audits on the district's school facilities allowing North Santiam to be one of the first districts to complete their

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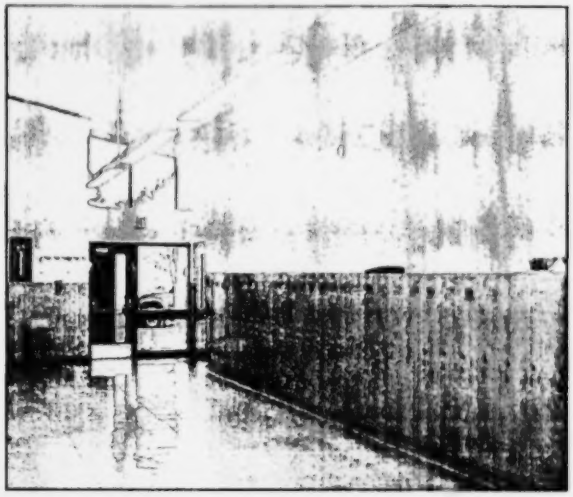
audits. For Phase I, Siemens recommended lighting, heating and control projects at Stayton Elementary and Middle Schools.



Hallways at Stayton Middle School are lighter and brigher thanks to the installation of new lighting.

Recommendations for Stayton Elementary:

- Replace older lighting with high quality energy efficient T-8 fluorescent lighting and electronic ballasts.
- Retrofit eight-foot metal-finned pendant-mounted fixtures with specially designed kits to lower operational costs, provide full-spectrum light, and improve appearance. Include four-foot T-8 fluorescent lamps that have a rated life of 24,000 hours and allow the school to standardize their lamp inventory. They also would eliminate the buzzing and flickering.
- Retrofit incandescent lighting to compact fluorescent and replace all non-LED (light emitting diode) exit signs with new LED exit signs. The compact fluorescent lamps consume about 25 percent of the energy used by incandescents and put out the same amount of light. The LED exit signs have a rated life of 50,000 hours compared with 1,500 hours for incandescents.
- Install a new distributed digital control (DDC) system to reduce energy use, extend equipment life, reduce maintenance and improve comfort in the classrooms. The rooftop ventilation system worked in conflict with the heating system, often heating and cooling simultaneously. This caused energy waste, overuse of equipment, and higher maintenance costs in addition to uncomfortable classrooms. The new DDC system allows for the boiler to be the first source of heating and the rooftop unit to come on as a second stage of heating if auxiliary heat is needed. During the cooling season, the DDC system uses the rooftop units to cool without outside air as the first source of cooling.

Recommendations for the Middle School:

- Replace outdated T-12 fluorescent lights with magnetic ballasts with T-8 fluorescent lighting and electronic ballasts. The new T-8s, while providing better quality lighting, don't flicker and have a rated life 33 percent longer than the T-12s.
- Replace inefficient high-bay mercury vapor lighting in the hallway and library with new high-bay metal halide fixtures that provide much better quality light.
- Replace incandescent lighting with compact fluorescent lights.
- Replace non-LED exit signs with new LED exit signs.

Ron Osborne, manager of the energy installation projects for North Santiam School District, shows off the roof top unit at Stayton Elementary School.

- Replace the pneumatic control system with a DDC system. The poorly maintained pneumatic control system was outdated technology. Parts were difficult to find and trained technicians were retiring. All temperature sensors, valves and actuators were replaced.

Financing

The cost for the recommendations for Phase I at Stayton Elementary and Middle Schools was $478,000.

Hogstad turned to the Office of Energy for a 5.75 percent, 15-year, fixed-rate energy loan so the district could begin the project. The loan of $332,250 would be paid with the money the district would save on energy use and the funds they collected from the SB1149 public purpose funds,

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approximately $35,000 a year or $350,000 for a 10-year period.

Hogstad also learned that the district was eligible for a tax credit offered by the Oregon Office of Energy. The Business Energy Tax Credit has been available to private-sector businesses since 1980 to encourage investment in energy conservation, renewable energy resources, recycling and alternative fuels.

The 2001 Legislature extended the tax credit to non-profit organizations and public entities effective October 8, 2001. A school could use the tax credit "Pass-through Option" and transfer the tax credit worth 35 percent of eligible project costs to a private business or individual with state tax liability. In exchange, the business or individual would provide the school with a lump-sum cash payment of 27 percent of the eligible project costs. Most of the Phase I project costs were eligible for the tax credit pass-through option.

Energy Loans

The Office of Energy offers low-interest, fixed-rate loans for projects that save energy, produce energy from renewable resources, use recycled materials to create products, or use alternative fuels.

For more information, school officials can contact Dennis Knight at the Oregon Office of Energy Loan Program at (503) 373-1032 or 1-800-221-8035.

Nike, an Oregon-based shoe, apparel and sports equipment manufacturer, agreed to be a pass-through partner to Oregon public schools that did energy projects that qualified for a Business Energy Tax Credit. Nike had Oregon tax liability; the schools did not. Nike committed $1 million to the partnership so the schools could transfer their tax credits to Nike in exchange for a cash payment.

"This is a win-win for everyone," says Jim Petsche, Nike's director of corporate facilities. "This is good for the environment and good for the schools. It shows how partnerships between government and business can save Oregon's greatest resources, schools and the environment."

For North Santiam's Phase I project, Nike would provide the school district with a $128,997 cash payment. In turn, Nike would receive a tax credit of $167,406.

New lighting does not flicker or hum like the previous lighting. The light quality improved too

Energy savings

To qualify for the tax credit pass-through, lighting projects are required to save a minimum of 25 percent and heating and cooling projects must show a minimum of 10 percent savings. Siemen's calculated an overall anticipated savings of nearly 31 percent for Phase I of North Santiam's project.

This translated into an estimated $29,000 in annual fuel savings.

The initial winter energy bills verify that savings. The December 2002 electricity bill was 39 percent less at Stayton Middle School from December 2001 with an average daily temperature down a degree. The gas bill for the Middle School was down by 50 percent. At the Elementary School, the gas bill in December 2002 showed a 29 percent reduction.

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The energy savings combined with the Nike tax credit pass-through payment and the SB 1149 funds are expected to cover the loan payments. Meanwhile, students, teachers and support staff benefit from a much-improved physical surroundings.

Empowering

"These have been great projects for our district and our students," said District Superintendent B.J. Hollensteiner. "The difference in lighting and the ability to control the heat, air movement, and coolness of buildings has really added to the environment for students and staff. Tom and the maintenance crew have spent a lot of time putting this together. I have been very impressed with their commitment to the district and improving the atmosphere for our students and staff. They are a great team and Tom is a dynamic leader."

Hogstad is pleased with the results. "It's fun. It's been a challenge," he said. "I have a lot of pride in this. But it never would have happened if not for the team - from B.J. and the School Board to the office and the maintenance staff, Eric and Siemens and the Office of Energy staff."

"Tom did his homework and used his resources very effectively," said Betty Merrill, School Program Manager for the Oregon Office of Energy. "Tom worked with us, and the results speak for themselves."

"The Office of Energy staff has been exceptional in offering information, support, guidance and critical thinking," Hogstad said. "They were truly a team partner in this."

What next?

North Santiam School District is analyzing financing options to begin the Phase II energy project at Stayton High School. The $796,000 for Phase II will complete the $1.2 million of proposed building upgrades for North Santiam.

Tom Hogstad is now a part-time consultant for the district. He currently is employed by the Deschutes Public Library System and oversees six facilities in Central Oregon. He also has an RFP out. "I want to duplicate what I did for North Santiam."

Business Energy Tax Credit Pass-through Option

The Business Energy Tax Credit Pass-through Option allows schools (or non-profit organizations and other public entities) to transfer a tax credit to a business or individual with an Oregon tax liability in exchange for a lump sum cash payment. The Business Energy Tax Credit application form must be completed and sent to the Office of Energy **BEFORE** the project begins. The tax credit amount is 35 percent of eligible project costs. The payment to the school is 27 percent of eligible project costs. Contact Roland Gilchrist or Catherine Hardy at 1-800-221-8035 or by e-mail sb1149.sch@state.or.us. for more information.

Catherine Hardy, School Program Specialist
Greg Churchill, Energy Analyst
(503) 378-4040 or (800) 221-8035

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Case Study: The Dalles Middle School

Energy use to drop dramatically

When you have a lemon — you make lemonade. The Dalles School District, 83 miles east of Portland, Oregon, was faced with a big lemon: a poorly built middle school located in a landslide area. The school district decided to make lemonade and turn a negative into a positive.

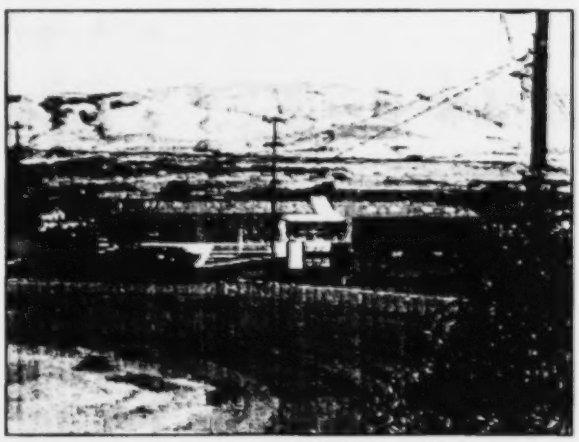
"...our architect and engineers tell us we could see up to a 60 percent cost reduction (in energy)."

– Dan Chamness
Business Manager
The Dalles School District

The Dalles new $12.5 million middle school opened in September 2002. It is one of the first schools in the nation that is heated and cooled with the very ground water that caused the landslides. The Oregon Office of Energy's School Program, in conjunction with Rebuild American and other U.S. Department of Energy program partners, provided technical assistance. This unique application of free geothermal energy and other energy-saving measures are expected to reduce the school's annual energy consumption by at least 46 percent.

District Business Manager Dan Chamness couldn't ask for much more. "We were conservative in our budget to reflect a 46 percent reduction in energy costs," Chamness said. "But, our architect and engineers tell us we could see up to a 60 percent cost reduction. We hope to be pleasantly surprised."

The 96,000 square-foot building was constructed for an estimated $104 per square foot (not including site work), reasonable for a school in Oregon. The project was both on budget and on time. Both Chamness and District Maintenance Supervisor Ross Cain noted that the number of change orders, that only add to the bottom line, were less than anticipated, too.



The lemon was turned into lemonade. The new school is comfortable

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and healthy for students and staff and energy and resource efficient. It is a high performance school that will serve as a model for other Oregon schools.

A 'temporary' school

The original middle school comprised of three buildings and a gym/cafeteria opened in 1955. Construction of The Dalles Dam had brought a sudden influx of students, and the school district had to respond quickly to meet the demand. They constructed "temporary" facilities on the Kelly Avenue Landslide Area expecting to be there for 20 years or less.

The 20 years turned into 45 years. They were not easy ones for the school district, students, staff or taxpayers. The shifting ground and hurried construction of the buildings resulted in expensive repairs and labor-intensive maintenance. The classrooms were uncomfortable for students and staff. Because there was little insulation, heating and cooling bills were high. There were constant problems that stretched the maintenance staff.

The Dalles Middle School

1200 East 12th Street
The Dalles, OR

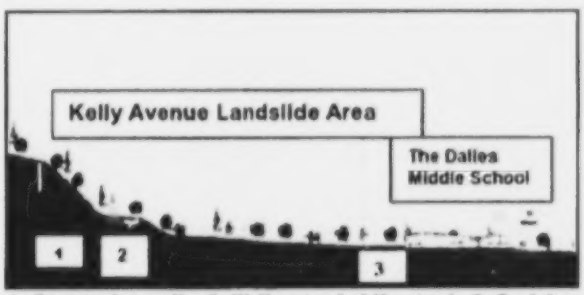
The Dalles School District No. 12
Superintendent: Cheryl Crawley
Principal: Jan Anderson

Architect: Heinz Rudolf, BOORA
Contractors: Turner Construction
Project Manager: Heery International

Groundbreaking: August 9, 2001
Open House: August 22, 2002

Cost: $12.5 million
600 students in grades 6,7,8
96,000-square-foot building
On 13 acres in residential area

There was talk of a new middle school when Cain joined the district in 1985. But, it was just that — talk. The decision to build a new middle school was made by the State Fire Marshall. He closed one of the buildings in 1995 and condemned the others following the 1999-2000 school year.



1. Dewatering wells; 2. Well water holding tank; 3. Rock key trench between slide area and new school site.

New building challenge

Building a new middle school posed quite a challenge for the district. The district selected a new school site, but voters rejected the building bond because the location was too far from the residential core. The district went back to the engineers to see if the existing site favored by the community could be used.

However, the favored site had landslide problems. In the late 1980s, in an attempt to mitigate the landslides, the city had rehabilitated the landslide area with six dewatering wells that drew water from the ground and two large well water holding tanks. These actions had stabilized the ground.

The engineers gave their approval for a new school to be built on the existing site with the addition of a rock key trench 180 feet long, 80 feet wide and 35 feet deep between the slide area and the school to further stabilize the school grounds. In addition, the original nine-acre site was expanded to 13 acres to allow for reorientation of the school to the far end of the landslide area. Voters were asked to approve a second building bond issue. This time, they approved.

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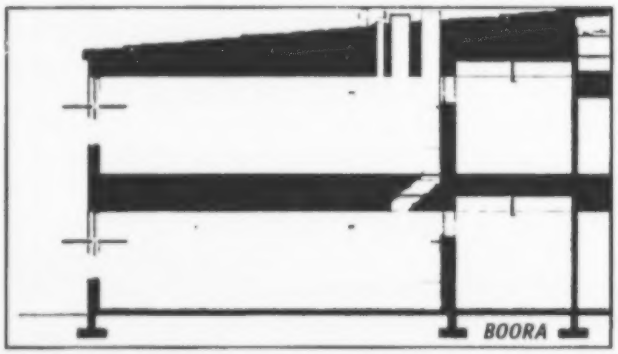
Building Design

The school district architect, Heinz Rudolf with BOORA architectural firm of Portland, is an advocate of energy efficient, "green" or sustainable buildings. He saw the 58 to 60 degree ground water being pumped from the landslide area as a readily available source of renewable energy for a new building.



Exterior and interior lights bounce the light deep into the classroom.

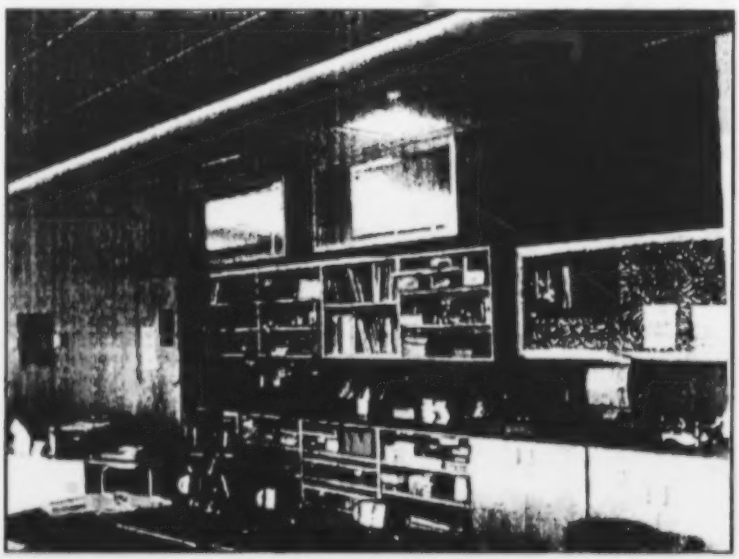
The water could provide both heating and cooling using geothermal principles. For heating, a heat pump extracts the heat from the water. For cooling, the heat pump reverses the process. In addition, the relatively cool ground water is used directly to chill the air flowing through the ventilation system that cools the building.

Heating and cooling are a large part of the energy use of a school building. Having a renewable resource, one that nature maintains at a constant supply over time, will impact on the bottom line. It is an attractive concept, but School District Maintenance Supervisor Ross Cain had to see for himself that this process would work. He researched the technology and visited several geothermal sites before he gave approval.

The unusual heating/cooling system is of special interest to the foreman who installed the heat pump. Bob Loftin attended the old middle school and lives in The Dalles. "This is a feather in our cap to do this," Loftin said. "The old school was a mess. We want to keep our kids in school and this new building will be nice. Now this community really has something they can be proud of. It puts us on the map."

Daylighting

The Dalles School District considered other measures to reduce energy use. It incorporated lots of natural light to reduce the need for electric lighting and the associated increase in the air conditioning load. More importantly, studies show that students perform better when skylights and windows bring natural, non-glare light inside the classroom. This is called "daylighting." (See Daylighting Report on Office of Energy Web site: www.energy.state.or.us/school/highperform.htm)



Light tube provides light in interior wall area. High windows on the interior walls allow light into the hallway.

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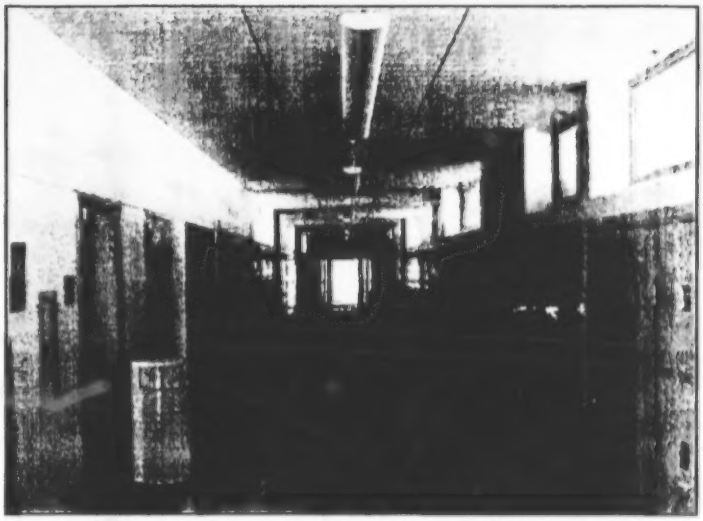
The Dalles Middle School has incorporated daylighting into each classroom using four methods.

1) The school is oriented so classrooms face north and south. They do not get direct western sun during the hottest time of the day.
2) The large windows have a special glazing to minimize glare and heat, but bring lots of natural light inside the room.
3) Light "shelves" are built on the outside and the inside of the windows. These three-foot reflective projections are located about a third of the way down the window. They reflect the sunlight to the white ceiling which "bounces" the light deeper into the room. The shelves also shade the lower window and reduce heat gains into the room caused by the sun.
4) One or two light tubes are located on the inside wall of the room to bring in additional natural light. The light tubes are much smaller diameter than a skylight and made of reflective material to bring direct sunlight and ambient light through the ceiling and into the room. A diffuser spreads the light evenly. Near the light tubes, three high windows within the classroom allow some of the light into the interior hallway. Both the first and second floors have light tubes and light shelves.



Natural light comes into the interior hallways of the new school from high windows on the interior walls of classrooms.

Gym skylights are lined with spun fiberglass to diffuse natural light.

Other energy efficient measures to include:

• The electric lights installed in the classroom are energy efficient fluorescent T-5s. They can be controlled separately so the fixture closest to the windows can be turned off, while the one closest to the interior wall can be left on, if necessary.

• The media center and computer labs have an entire wall of windows. There are no light tubes in these rooms as the wall of windows brings in abundant light.

• Windows that face west have vertical sunscreens that provide shade in late afternoon without blocking the view.

• In the gym, several interior skylights are lined with a spun fiberglass. This diffuses the light so there is no direct sunlight on the gym floor.

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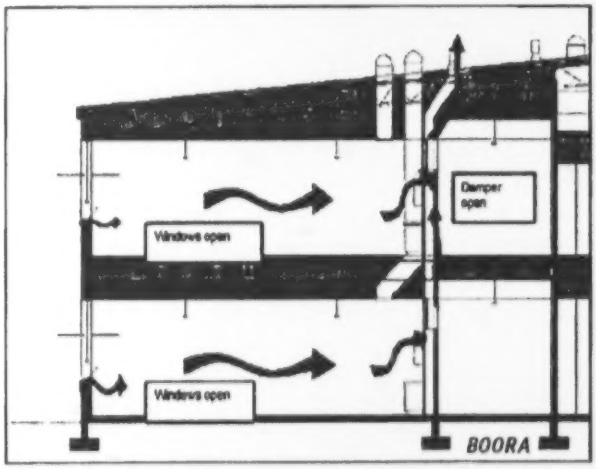
Natural ventilation

The middle school design included an old concept into the new building — natural ventilation. The operable windows pull fresh air into one side of the classroom, while ventilation stacks (chimney-like devices) pull the air out on the opposite side of the classroom. When outside temperature conditions are within a certain range, teachers can open the windows. When outside temperatures are too high or too low, the back-up mechanical ventilation system automatically turns on.



Green/red light system lets teachers know when to open windows.

The benefits of natural ventilation are substantiated in studies of student performances. (See Daylighting Report on Office of Energy Web site: www.energy.state.or.us/school/highperform.htm). Natural ventilation connects students and staff to the outside and can be easily controlled. In addition, natural ventilation saves energy, maintenance and has lower initial costs.

Sustainable Building

The school district took considerable care to make the building a high performance school that will save energy, natural resources and money. For example:

- They controlled erosion through grading, sediment control and landscaping, in addition to rehabilitating the damaged landslide area.
- They used light-colored concrete for the parking area to reduce heat "islands."
- They directed the exterior lighting downward to reduce night light pollution.
- They included 176 bicycle parking spots and even an area for a future electric car charging station.
- They used drought-resistant plantings.
- They are irrigating the three ball fields behind the school with the reclaimed ground water.
- Building materials were specified to contain post-consumer recycled content.
- They had building contractors recycle or salvage construction waste.
- They specified that building materials contain post-consumer recycled content.
- They ordered toilet and shower partitions made from recycled plastic.
- They used ceiling tiles produced from 75 percent post-consumer recycled waste.
- They used local building products when possible to avoid transporting materials long distances and consuming more fuel.
- They designed a recycling center in the building.
- They used paints, wood stains and sealers with low or no-volatile organic compounds (VOCs) as much as possible.
- They mechanically zoned science classrooms to avoid exposure to hazardous chemicals.
- They stained the concrete walls to look like basalt rock and to blend with the colors of the natural landscape.

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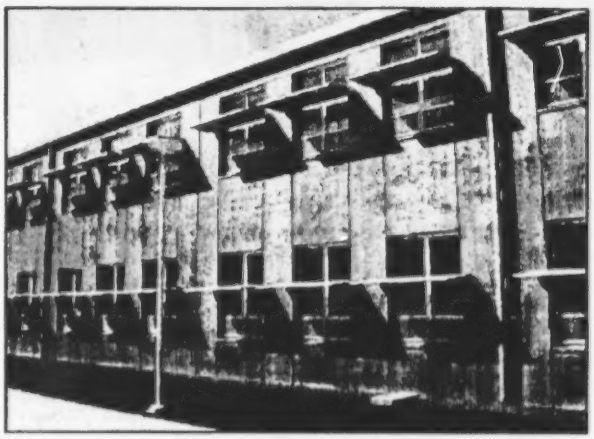
Commissioning

A key to operating a building as it was intended to run is to have a commissioning agent involved during the construction process. Commissioning is the systematic process of ensuring that building systems are designed, installed, tested and capable of being operated and maintained to perform according to the design intent and owners' needs. The Dalles School District included this expense in their plans.



The new school walls are concrete and stained to look like basalt rock. Note the shading the light shelves provide to reduce glare and heat gain inside the classroom.

Commissioning begins in the design phase. The commissioning agent's task is to identify system deficiencies as early as possible in the project and to track their status until they are corrected. The result will be improved tenant comfort and productivity, improved air quality, reduced operation, maintenance and equipment replacement costs and lower energy costs. It includes the training of operating staff. Commissioning agents may be an independent third party, a design professional, a general contractor or a mechanical contractor.

The cost of commissioning can vary considerably with the size of each project and the level of commissioning. For whole-building commissioning, the price range is normally 0.5 to 1.5 percent of total design and construction cost. For The Dalles building, commissioning costs were $55,000.

Going for Gold

Because the building incorporates numerous sustainable materials and ideas as well as many energy-saving measures, The Dalles School District has applied for the gold certification level from the U.S. Green Building Council's LEED™ (Leadership in Energy and Environmental Design) Program. The U.S. Green Building Council independently reviews all the construction documents for energy efficiency and environmentally sustainable products. The gold certification is the second highest level. Only 26 schools in the nation have applied for a LEED certification rating.

The Dalles Middle School also received an Energy Award from the Oregon Office of Energy for outstanding design achievement.

"The Dalles School District has created a high performance school that is an asset to the community, enhances teaching and learning, reduces operating costs and protects the environment," said Director of the Oregon Office of Energy Michael Grainey.

Greg Churchill
(503) 378-4040 or (800) 221-8035 • www.energy.state.or.us

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